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INTERNATIONAL APPLICATION PUBLISHED UNDER THE PATENT COOPERATION TREATY (PCT)

(51) International Patent Classification 6 :
H04B 3/54, H02J 13/00, H04L 12/413

A1

(11) International Publication Number: WO 99/66655

(43) International Publication Date: 23 December 1999 (23.12.99)

(21) International Application Number: PCT/KR99/00314

(22) International Filing Date: 17 June 1999 (17.06.99)

(30) Priority Data:
1998/22801 17 June 1998 (17.06.98) KR

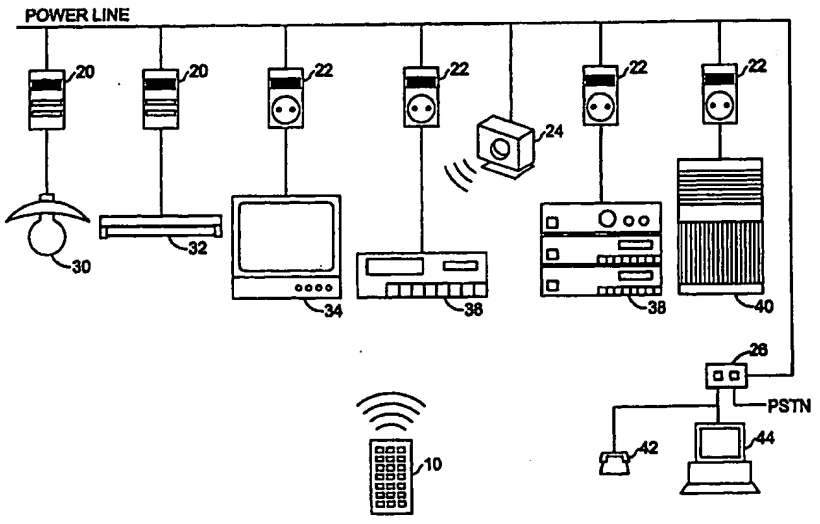
(71)(72) Applicant and Inventor: KIM, Chul [KR/KR]; 5-1207 Shindonga Apt., 779 Yongdu-dong, Dongdaemun-gu, Seoul 130-070 (KR).

(74) Agent: KWON, Yong-nam; Osung Building Room 506, 831-42 Yeoksam-dong, Kangnam-gu, 135-080 Seoul (KR).

(81) Designated States: CA, CN, JP, US, European patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE).

Published
With international search report.
Before the expiration of the time limit for amending the claims and to be republished in the event of the receipt of amendments.

(54) Title: APPLIANCE CONTROL SYSTEM UTILIZING BIDIRECTIONAL POWER LINE COMMUNICATIONS



(57) Abstract

A control system for controlling operations of a plurality of electric appliances in distributed arrangements. The system comprises a power line; a plurality of controllers (20, 22, 24, 26) each of which is connected between the power line and one of the plurality of electric appliances (30, 32, 34, 36, 38, 40, 42, 44); and input means (10) for providing a control message to at least one of the plurality of controllers. The at least one of the plurality of controllers which receives the control message provides the control message to another one of the plurality of controllers via the power line. The at least one of the plurality of controllers which receives the control message may be selected arbitrarily by a user of the input means (10).

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APPLIANCE CONTROL SYSTEM UTILIZING BIDIRECTIONAL POWER LINE COMMUNICATIONS

Technical Field

The present invention relates to a system for remotely controlling electrical appliances, and more particularly, to a system for remotely controlling electrical appliances utilizing power line communications and a data communication method therefor.

Background Art

Power line communications have been utilized primarily to remotely control multiple electrical devices in distributed arrangements. In a typical power line communication system, data is modulated in a carrier having a frequency sufficiently higher than that of the AC supply voltage. The modulated wave packets are superimposed near zero-crossing points of the AC supply voltage so as to reduce an influence of noise in the power line on the system. Also, in order to further enhance a noise-immunity of the system, a data bit to be transmitted is represented by two packet positions as shown in FIG. 1. That is, a data bit is indicated by an existence or not of a packet at a zero-crossing point along with its complement at a next zero-crossing point.

In most applications utilizing such a power line communication method, more than two controllers are arranged in a manner that each controller is connected to an appliance. In such a system, however, if two controller attempts to transmit data simultaneously, data from the controllers collide and cannot be retrieved in a receiving party. Referring to FIG. 3, which illustrates a collision during a data transmission, two identical states may exist at neighboring zero-crossing points even though such a state is prohibited in a normal state.

Because of the reason, conventional power line communication methods have been not used for bidirectional communications. Also, any technical proposal for enabling bidirectional communications in a power line system has not been reported yet. Accordingly, in a conventional system, each of a plurality of receivers has to unilaterally receive control data from a master controller as shown in FIG. 2, but cannot send data to the master controller or another receiver. Even though such a system may be satisfactory in industrial applications such as a security alarm system, a garage door opener, and a lighting system in a building, the system cannot fulfill the needs of users at home. For example, a user at home wishes to control electrical appliances in each room no matter where she or he is.

Disclosure of the Invention

To solve the above problem, one object of the present invention is to provide a system in which each controller allocated for each of a plurality of appliances communicates with one another so that the operation of the plurality of electric appliances in distributed arrangements are controlled conveniently.

Another object of the present invention is to provide a method for enabling bidirectional communications in a system utilizing power line communications, so that each controller engaged in the power line communication system communicates with each other.

To achieve one of the above objects, a control system of the present invention comprises: a power line; a plurality of controllers each of which is connected between the power line and one of the plurality of electric appliances; and input means for providing a control message to at least one of the plurality of controllers. The at least one of the plurality of controllers which receives the control message provides the control message to another one of the plurality of controllers via the power line. The at least one of the plurality of controllers which receives the control

message may be selected arbitrarily by a user of the input means.

A method of transmitting data to the plurality of external controllers according to the present invention to achieve another one of the above objects is implemented in a controller connected to at least one electric appliance for controlling an operation of the at least one electric appliance and to a plurality of external controllers through a power line to communicate bidirectionally with the plurality of external controllers for receiving and transmitting a control message for controlling the operation of correspondingly connected electric appliance. The method comprises the steps of: (a) transmitting a first data to the plurality of external controllers via the power line and detecting a second data from the power line; (b) comparing the first and the second data; and □in case that the first and the second data is not the same as each other, determining that a failure occurred, canceling the transmitting step, and re-transmitting the first data to the plurality of external controllers after a delay time is elapsed.

Brief Description of the Drawings

The above objects and advantages of the present invention will become more apparent by describing in detail preferred embodiments thereof with reference to the attached drawings in which:

FIG. 1 illustrates a typical shape of a modulated signal in a power line communication system;

FIGS. 2A and 2B illustrate a conventional power line communication method;

FIG. 3 is a waveform diagram for explaining a collision during a data transmission in the power line communication system;

FIG. 4 exemplifies a home automation system employing controllers according to the present invention;

FIG. 5 illustrates a bidirectional power line communication method between the controllers in the present invention;

FIG. 6 is a table summarizing house codes which can be assigned to a plurality of neighboring systems and addresses which can be assigned to the controllers in a system;

FIG. 7 illustrates a data format which is used in the bidirectional power line communication of the present invention;

FIG. 8 is a block diagram of an embodiment of the controller according to the present invention; and

FIGS. 9A and 9B are flowcharts showing a data communication method in a power line communication system employing the controller of FIG. 8.

In the drawings and following description, the same reference numerals will be given to similar or corresponding elements.

Embodiments

Referring to FIG. 4, a home automation system employing controllers according to the present invention includes a plurality of controllers 20, 22, 24, and 26, and electric appliances 30 through 40 powered through the controllers 20, 22, and 26. Each of the controllers 20, 22, 24, and 26 is connected to a power line and controls the operation of the appliance connected thereto in response to a respective control signal.

Among the controllers, the controller 20, which is a switch module, controls the turning on or off and dimming of a lighting such as an electric lamp 30 and a fluorescent lamp 32. The controller 22, which is a receptacle module, has two holes for inserting a plug of an appliance and maintains or stops a power supply to the appliance connected thereto. Appliances which may be powered through the controller 22 include a television receiver 34, a video cassette recorder (VCR) 36, a component audio system 38, and an air conditioner 40. The controller 24 is an infrared (IR) generator operative as a remote controller signal generator which itself is controlled remotely. Such a controller 24 controls the turning on/off, and

the volume level of appliances in front of the controller 24 in response to a control signal provided externally.

In the present invention, the control signal for controlling the operation of one of the controllers is provided in various manners. First, the control signal may be provided directly from the remote controller 10 manipulated by the user. For this purpose, each of the controllers 20, 22, and 24 has an IR sensor on the front panel thereof. Also, the controller may be provided with the control signal from a separate switch or a sensor. For example, a light controller 20 for controlling the lighting 20 or 32 has at least one on/off switch, so that the user turns on/off the lighting 20 or 32 by use of the switch. In case that the lighting 20 or 32 is installed on the ceiling of a passage or a staircase, the lighting may be incorporated with a illumination detection sensor so that the lighting is turned on/off in response to a control signal from the sensor.

Meanwhile, each controller can bidirectionally communicate with another through a power line. FIG. 5 illustrate such bidirectional communications between the controllers. Accordingly, each controller can receive a control signal from the remote controller 10 via another controller. In such a case, a controller receiving the infrared signal from the remote controller 10 provides the control signal to another controller via the power line no matter to what appliance the control signal is directed. In an alternative embodiment, however, the controller receiving the infrared signal may provide the control signal only when it is determined that the control signal carried by the infrared signal is not directed to itself, which is described in detail below.

On the other hand, the controller 26 operative as a telephone module in FIG. 4 has a terminal connected to a telephone line by use of a RJ-11 connector, another terminal connected to the power line, and the other terminal connected to a telephone 42 or a telephone port of a computer 44. The telephone module 26 can receive an incoming call by

itself, and receive and modulate a control signal transferred through the telephone channel in a call-receiving mode to transmit a modulated signal to the other controllers. Thus, the user can make a call to the home from outside to control the operation of the appliances. Those of skilled in the art will appreciate that such a telephone module can be implemented easily from the following description of the other kinds of controllers.

In order to ensure the bidirectional communication and the transfer of control signal between the controllers, each controller is assigned with its own address. Also, to suppress any interference between adjacent houses or systems, each system is assigned with its own house code. FIG. 6 summarizes house codes which can be assigned to each of a plurality of neighboring systems and addresses which can be assigned to each of the controllers in a system. As can be seen in the drawing, the house code is comprised of eight bits and has one value in a range from 1 to 255. A house code of value 0 is not used since the code value cannot be discriminated from a null state, i.e., a state in which there is no signal being transferred through the power line. Also, the controller address is comprised of eight bits and has one value in a range from 0 to 255. Meanwhile, some but insignificant number of controllers may have only signal receiving capabilities rather than bidirectional communication capabilities, so that the user can reduce the system cost.

When the system is installed initially, the house code and the address both of which are stored in each controller is in the initial condition of 00H. If the user issues a setup command by use of the remote controller 10, for example, at least one of the controllers transmits a hail request signal through the power line in response to the command. All the controllers receiving the hail request responds to the request by sending a house code and address stored therein. At this time, controllers in neighboring systems can participate in the responding. The controller which issued the hail request selects randomly one of the house codes

which is possible but not used by the neighboring systems and determines the selected house code as the code for the system. The determined house code is notified to the other controllers in the system. Meanwhile, the controller addresses may be assigned by the user. Alternatively, however, the addresses may be arranged by the controller which issued the hail request.

On the other hand, control signals for activating the controllers are comprised of four bits. Thus, the system has sixteen kinds of control signals. Besides the power on/off instruction, the control signals include a status request and turning off instruction directed to all the controllers, and so on. Also, the house code update instruction may be one of the control signals. Control signals not shown in FIG. 6 may be reserved for the choice of the user.

FIG. 7 illustrates a data format which is used in the bidirectional power line communication of the present invention. As can be seen in the drawing, the house code of eight bits is incorporated with parity check bits of four bits and thus represented in twelve bits. Similarly, the controller address of eight bits is incorporated with parity check bits of four bits and thus represented in twelve bits. Here, the parity check bits are obtained according to Hamming code scheme. As the parity check bits are introduced, each controller can correct some random errors by itself in the present invention. Also, the delay in the communications due to the Automatic Response Request (ARQ) and acknowledgment (ACK) may be obviated. In the description below, a data structure of 32 bits shown in the FIG. 7 will be referred to as a control message.

The reader should note that, in the present invention, all or significant number of controllers are operative as a master controller which controls the other controllers, rather than just a signal controller operates as a master controller while the other ones operate as a passive or slave controller. Accordingly, in a house equipped with the home automation

system of FIG. 1, the user can control any appliance in the other room or outside the house by giving an appropriate command by use of the remote controller 10 no matter where the user is. Thus, the benefits of the home automation system is enhanced considerably.

FIG. 8 is a block diagram of an embodiment of the controller according to the present invention. The controller includes an input unit 50, a transmitting and receiving unit 60, a delay generator 70, a driving unit 80, and a memory 82.

The input unit 50 receives input data from the remote controller, the switch, or the sensor. If the received data is provided by the switch or the sensor and is a control signal directed to the controller itself, the input unit 50 provides the received data to the driving unit 80 so that the driving unit 80 carries out an operation corresponding to the input data. For the sake of simplicity, any signal path for this case is not shown in FIG. 8. On the other hand, in case that the received data is the control message provided by the remote controller 10, the input unit 50 stores the received data in an internal buffer and provides such data to the transmitting and receiving unit 60 so that the transmitting and receiving unit 60 transmits the data through the power line.

The transmitting and receiving unit 60 transmits the control message from the input unit 50 through the power line and receives a control message from the power line. Also, the transmitting and receiving unit 60 monitors whether data from more than one controllers collide in the power line. In the transmitting and receiving unit 60, a zero-crossing detector 62 detects a zero-crossing point while following the AC voltage level of the power line, to output a zero-crossing detection signal. A modulator 64 modulates the control message from the input unit 50 in synchronicity with the zero-crossing detection signal. The present invention employs the conventional modulating scheme of FIGS. 1A and 1B, and thus detailed description thereof will be omitted.

A transceiver 66 transmits a modulated signal from the modulator 64. Also, the transceiver 66 detects the voltage level of the power line to receive a control message superimposed in the AC voltage. A carrier detector 68 detects a control message from the power line voltage level in synchronicity with the zero-crossing detection signal. A comparator 69 receives the input data and the control message from the input unit 50 and the carrier detector 68, respectively, and compares such data. If the comparison result shows that the input data and the control message are the same as with each other, the comparator 69 determines that the control message was derived from the controller in which the comparator itself is included. In case that the input data and the control message are not identical, however, the comparator 69 determines that a data collision happened and outputs a collision detection signal CD_OUT.

When a data collision happens, the delay generator 70 generates a delay signal for delaying the transmission of the data from the input unit 50. For this end, a collision counter 82 counts the collision detection signal CD_OUT to output a counted collision number (p). A random number generator 84 selects a number in a range from 0 to (2^p-1) according to a predetermined random number generating algorithm. Accordingly, the larger the accumulated collision number (p) is, the wider the range of numbers which can be adopted as the random number. A delay calculator 86 calculates a delay time which is determined based on the random number as follows.

$$Delay\ (D) = T * (Number\ of\ data\ bits\ of\ control\ message) * f$$

In the above equation, the number of data bits of control message indicates the number of bits included in one control message and is 32 in the case of data format of FIG. 7. Meanwhile, f denotes the frequency of AC voltage and is 50 Hz or 60 Hz depending on the country in which the

system is used.

When the delay time is expired, the input unit 50 outputs the input data to the transmitting and receiving unit 60 again, so that the transmitting and receiving unit 60 re-transmits the control message through the power line. In the present embodiment, the delay calculator 76 provides a trigger signal to the input unit 50 when the delay time is expired, so that the input unit 50 outputs the stored data in response to the trigger signal. In an alternative embodiment, however, the delay calculator 76 provides a calculated delay time to the input unit 50, so that the input unit 50 waits for the expiration of the delay time and outputs the stored data upon the completion of downcounting of the delay time. Alternatively, the input unit 50 and the delay generator 80 may be implemented in a microcontroller. In such a case, the input unit 50 and functional blocks in the delay generator 80 are implemented by an executable computer software loaded in the microcontroller.

The driving unit 80 receives the control message and the collision detection signal CD_OUT from the carrier detector 68 and the comparator 69, respectively. When the collision detection signal CD_OUT is deactivated and the address contained in the control message is the same as that stored in the memory 82, the driving unit 80 performs a control operation dictated by the control signal in the control message. When the address contained in the control message is not the same as that stored in the memory 82, i.e., the control message is directed to another controller, the driving unit 80 does not perform the control operation dictated by the control signal in the control message. Also, when the collision detection signal CD_OUT is activated to indicate a data collision status, the driving unit 80 does not perform the control operation dictated by the control signal in the control message. In the present embodiment, the memory 82 is implemented by an EEPROM and stores setup parameters of the controller including the house code and the controller address.

FIGS. 9A and 9B are shows a data communication method in a power line communication system employing the controller of FIG. 8. In an initial state (step 100), each controller maintains a stand-by status while determining whether there is a received signal (step 102). If there is data to be transmitted, the collision counter 82 is reset so that the collision number (p) is initialized to zero (step 104). Also, data to be transmitted is temporarily stored in the buffer of the input unit 50 (step 106). Subsequently, zero-crossing points are detected in step 108, and the massage to be transmitted is transferred near the zero-crossing points while the message imposed in the power line is received (steps 110 and 112).

Afterwards, the transmitted data is compared with the received data to determine whether there exists a data collision in the power line (step 114). If the data to be transmitted is identical to the received data until the data is completely transmitted, the controller determines that any data collision has happened and prepares to receive and send next message (step 102). If the data to be transmitted is not identical to the received data, however, the controller determines that a data collision has happened and stops the transmission and prepares a re-transmission.

Steps 116 through 124 shows the preparation of the re-transmission in detail. When a collision occurs, the collision number (p) is incremented by one and a random number is generated in a range of (2^p-1) which is one in this situation (steps 116 and 118). Subsequently, a delay time for re-transmission is determined based on the random number (step 120). Afterwards, the controller is in the stand-by state while downcounting the delay time determined in the step 120 (steps 122 and 124). When the delay time is expired, the procedure is returned to the step 108 so that the controller attempts a re-transmission.

Meanwhile, if another collision occurs during the re-transmission

procedure, the collision number (p) is incremented to two in this case. Accordingly, the range from which the random number is generated is enlarged. That is, while the random number may have zero or one just after the first collision, but the number may have one value from zero to three. Further, after another re-transmission is tried but failed because of a third collision, the random number may have one value from zero to seven.

As described above, the present embodiment adopts a collision detect multiple access (CDMA) scheme for bilateral communications between the controllers. As another collision occurs, the stand-by period may be lengthened so that the possibility of a successful transmission is enhanced.

Although the present invention has been described in detail above, it should be understood that the foregoing description is illustrative and nor restrictive. Those of ordinary skill in the art will appreciate that many obvious modifications can be made to the invention without departing from its spirit or essential characteristics. In practice, other specialized circuitry could be used to perform the same function as called for by the specific application. Accordingly, the scope of the invention should be interpreted in the light of the following appended claims.

Industrial applicability

As described above, In the present invention, all or significant number of controllers are operative as a master controller which controls the other controllers, rather than just a signal controller operates as a master controller while the other ones operate as a passive or slave controller. Thus, the versatility of the power line communication systems are enhanced significantly. Particularly, in a house equipped with the home automation system of FIG. 1, the user can control any appliance in the other room or outside the house by giving an appropriate command by use

of the remote controller 10 no matter where the user is. Thus, the benefits of the home automation system is enhanced considerably.

What is claimed is:

1. A control system for controlling operations of a plurality of electric appliances in distributed arrangements, comprising:

a power line;

a plurality of controllers each of which is connected between the power line and one of the plurality of electric appliances; and

input means for providing a control message to at least one of the plurality of controllers,

wherein the at least one of the plurality of controllers which receives the control message provides the control message to another one of the plurality of controllers via the power line,

wherein the at least one of the plurality of controllers which receives the control message may be selected arbitrarily by a user of the input means.

2. The control system as claimed in claim 1, wherein each of the plurality of controllers comprises:

an input unit for receiving the control message from the input means;

signal transmitting and receiving means for modulating the control message to transmit a modulated signal to another one of the plurality of controllers via the power line, detecting a signal in the power line, and detecting whether the modulated signal collides with another signal from at least one of the other controllers; and

a delay generator for generating a delay control signal so that the signal transmitting and receiving means re-transmits the modulated signal in accordance with the delay control signal.

3. The control system as claimed in claim 2, wherein the delay generator comprises:

a random number generator for generating a random number in a numerical window of which size changes according to an accumulated number of collision; and

a delay calculator for calculating a delay time on the basis of the random number so that the signal transmitting and receiving means re-transmits the modulated signal after the delay time is elapsed.

4. The control system as claimed in claim 1, further comprising:

an infrared signal generator for receiving the control message from one of the plurality of controllers to radiate an infrared signal for controlling an operation of at least one of the plurality of electric appliances.

5. In a controller connected to at least one electric appliance for controlling an operation of the at least one electric appliance and to a plurality of external controllers through a power line to communicate bidirectionally with the plurality of external controllers for receiving and transmitting a control message for controlling the operation of correspondingly connected electric appliance, a method of transmitting data to the plurality of external controllers, comprising the steps of:

transmitting a first data to the plurality of external controllers via the power line and detecting a second data from the power line;

comparing the first and the second data; and

in case that the first and the second data is not the same as each other, determining that a failure occurred, canceling the transmitting step, and re-transmitting the first data to the plurality of external controllers after a delay time is elapsed.

6. The method as claimed in claim 1, wherein the delay time is determined based on a magnitude of a random number selected from a numerical window of which size changes according to an accumulated

number of the failure.

FIG. 1

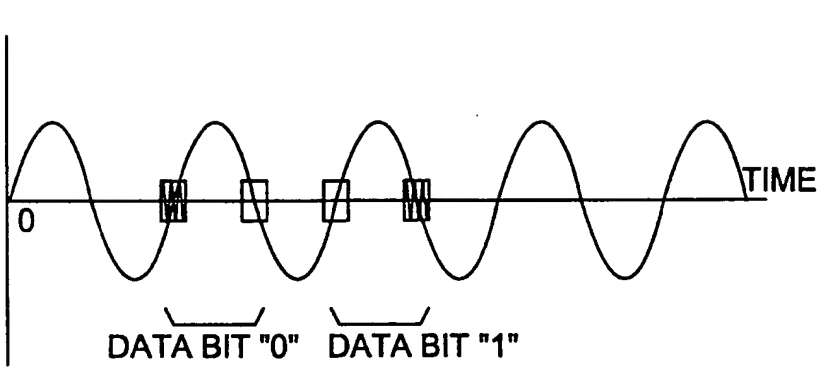


FIG. 2A

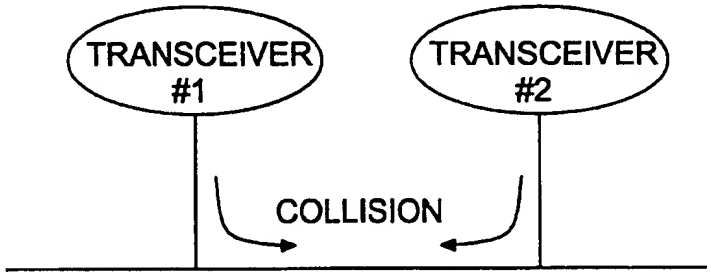


FIG. 2B

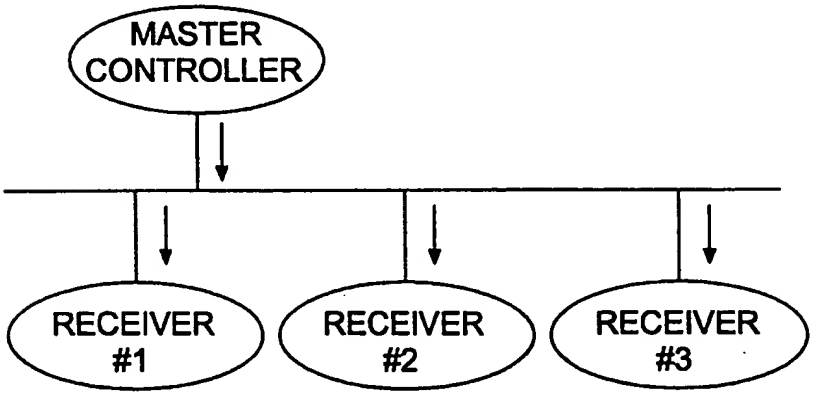
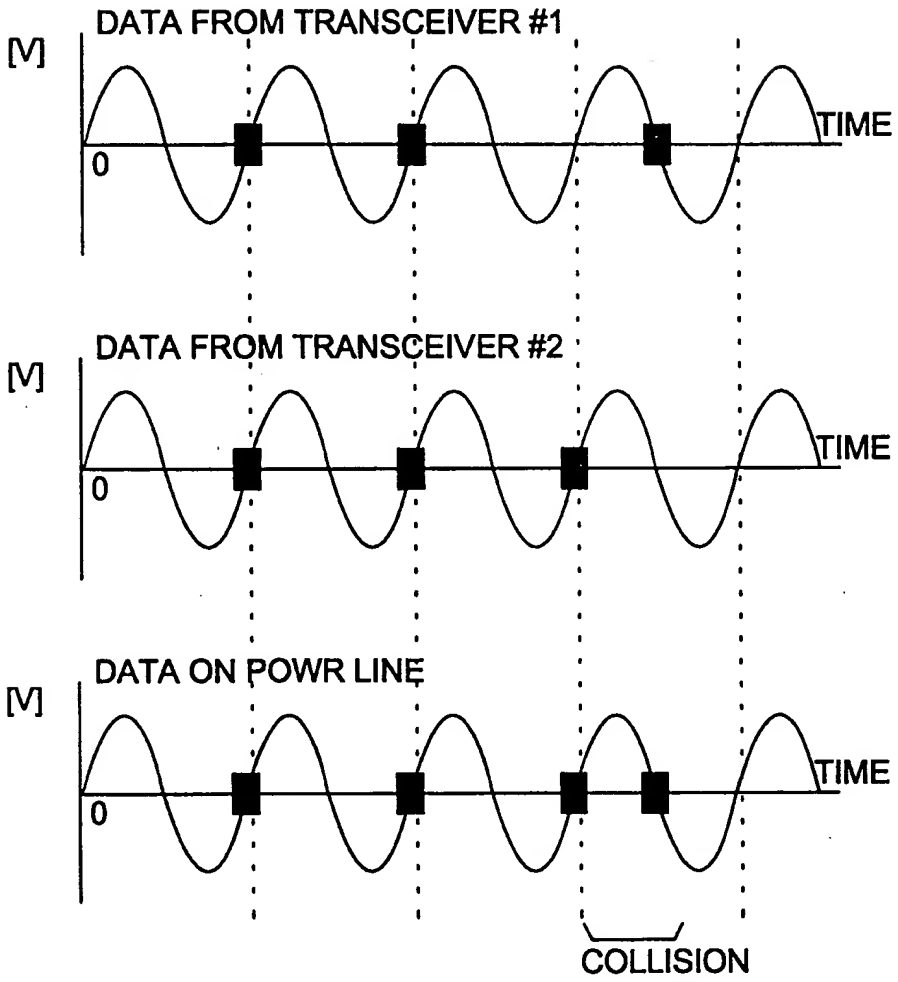


FIG. 3


DATA FROM TRANSCEIVER #1
[V]
TIME
0
DATA FROM TRANSCEIVER #2
[V]
TIME
0
DATA ON POWR LINE
[V]
TIME
0
COLLISION

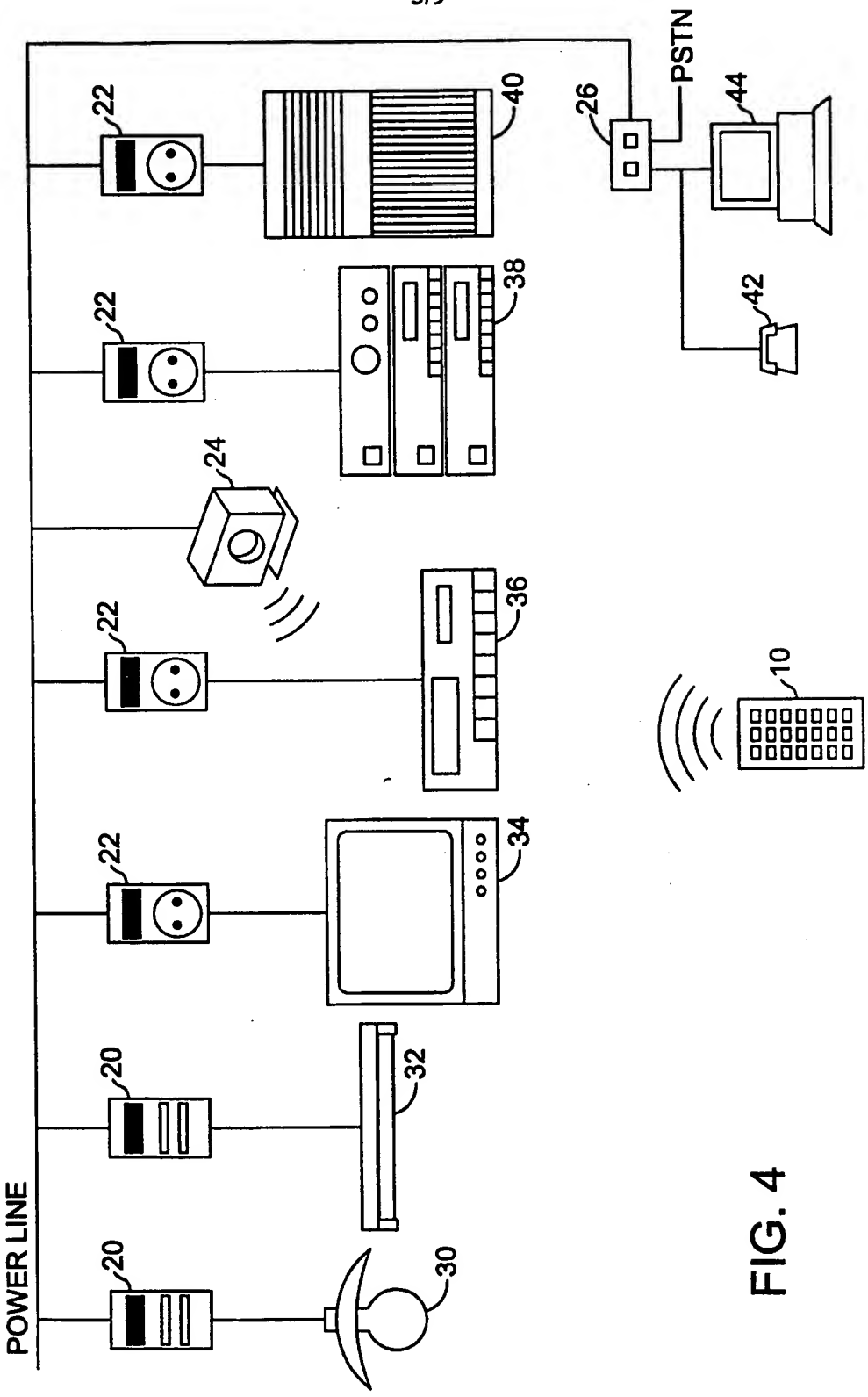


FIG. 4

FIG. 5

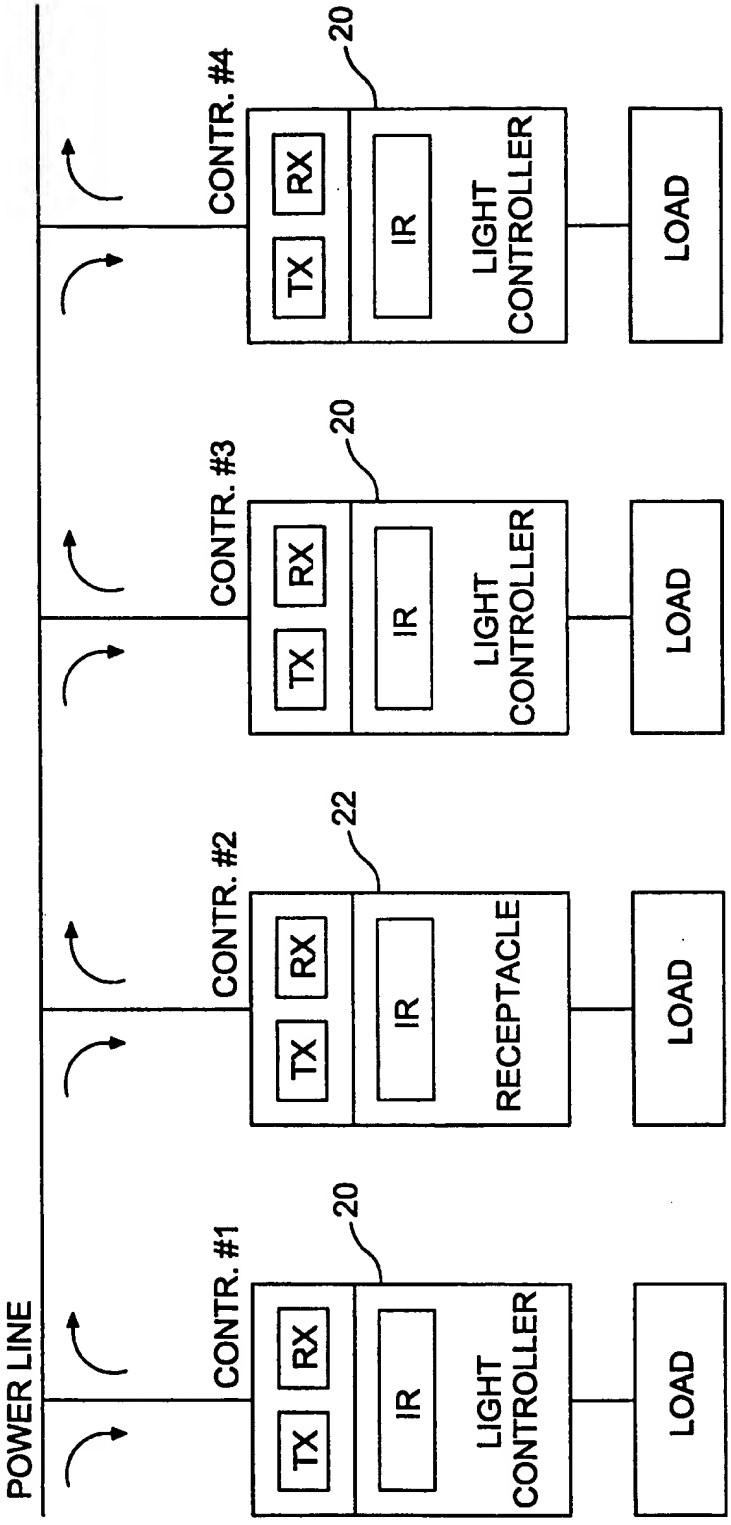

POWER LINE
CONTR. #1
CONTR. #2
CONTR. #3
CONTR. #4
TX
RX
IR
LIGHT CONTROLLER
RECEPTACLE
LOAD
20
22

FIG. 6

HOUSE CODE		CONTROLLER ADDRESS			CONTROL SIGNAL	
00H	--	00H	1-ST CONTR.	(TRANSCEIVER)	00H	ALL OFF
01H	1-ST SYSTEM	01H	2-ND CONTR.	(TRANSCEIVER)	01H	ALL ON
02H	2-ND SYSTEM	02H	3-RD CONTR.	(TRANSCEIVER)	02H	ON
03H	3-RD SYSTEM	03H	4-RD CONTR.	(TRANSCEIVER)	03H	OFF
04H	4-TH SYSTEM	...	...	...	04H	DIM
05H	5-TH SYSTEM	DFH	224-TH CONTR.	(TRANSCEIVER)	05H	BRIGHT
06H	6-TH SYSTEM	E0H	225-TH CONTR.	(RECEIVER ONLY)	06H	ALL LIGHT ON
...	...	...	...	...	07H	ALL LIGHT OFF
FDH	253-TH SYSTEM	FDH	254-TH CONTR.	(RECEIVER ONLY)	08H	STATUS REQUEST
FEH	254-TH SYSTEM	FEH	255-TH CONTR.	(RECEIVER ONLY)	09H	STATE ON
FFH	255-TH SYSTEM	FFH	256-TH CONTR.	(RECEIVER ONLY)	10H	STATE OFF

FIG. 7


HOUSE CODE (8 BITS)
+ PARITY (4 BITS)
CONTROLLER ADDRESS (8 BITS)
+ PARITY (4 BITS)
CONTROL SIGNAL (8 BITS)
+ PARITY (4 BITS)

FIG. 8

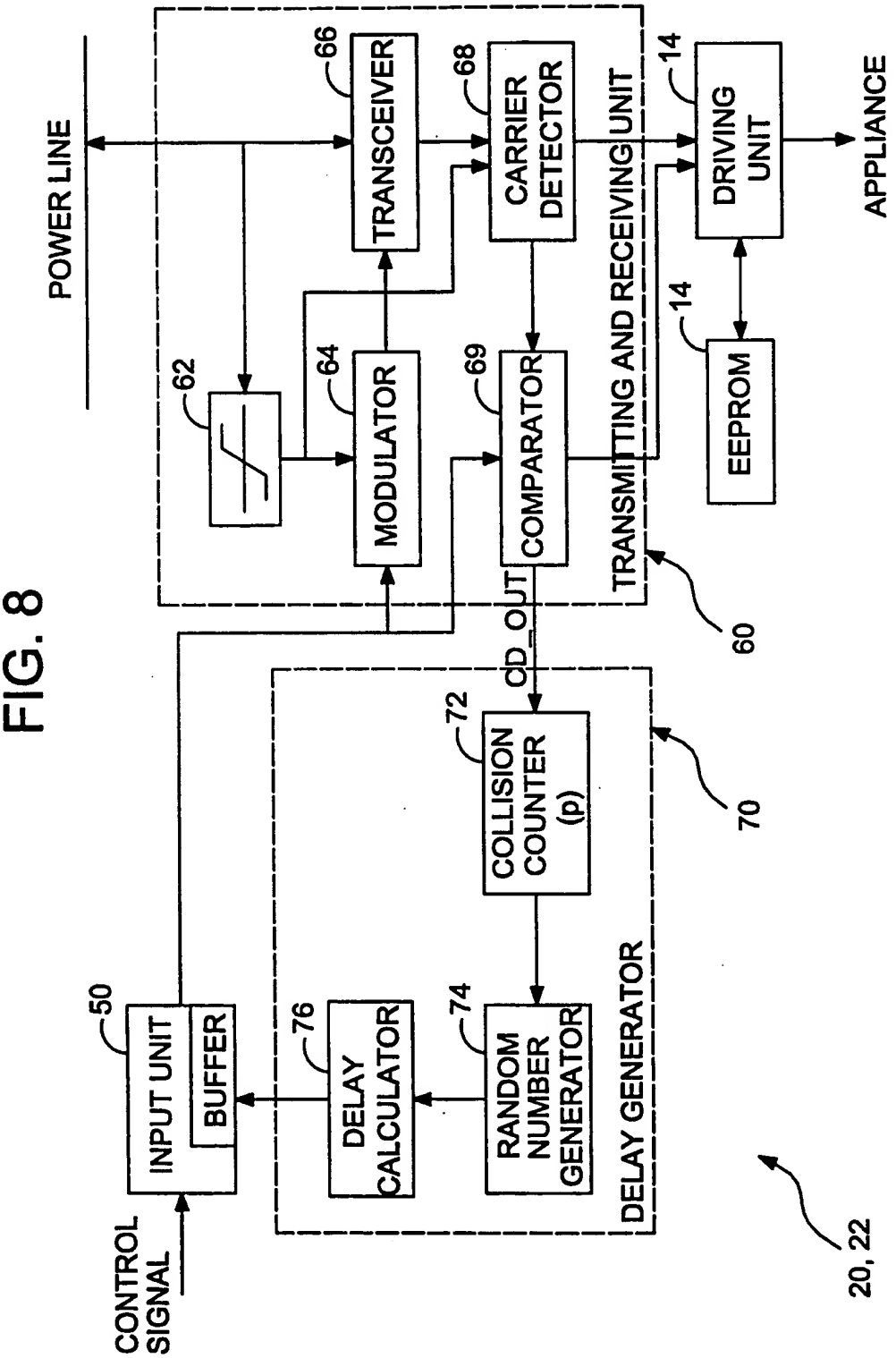

POWER LINE
APPLIANCE
TRANSCEIVER
CARRIER DETECTOR
DRIVING UNIT
MODULATOR
COMPARATOR
EEPROM
TRANSMITTING AND RECEIVING UNIT
CD_OUT
COLLISION COUNTER (p)
DELAY GENERATOR
INPUT UNIT
BUFFER
DELAY CALCULATOR
RANDOM NUMBER GENERATOR
CONTROL SIGNAL
62
64
66
68
69
72
74
76
50
60
70
14
14
20, 22

FIG. 9A

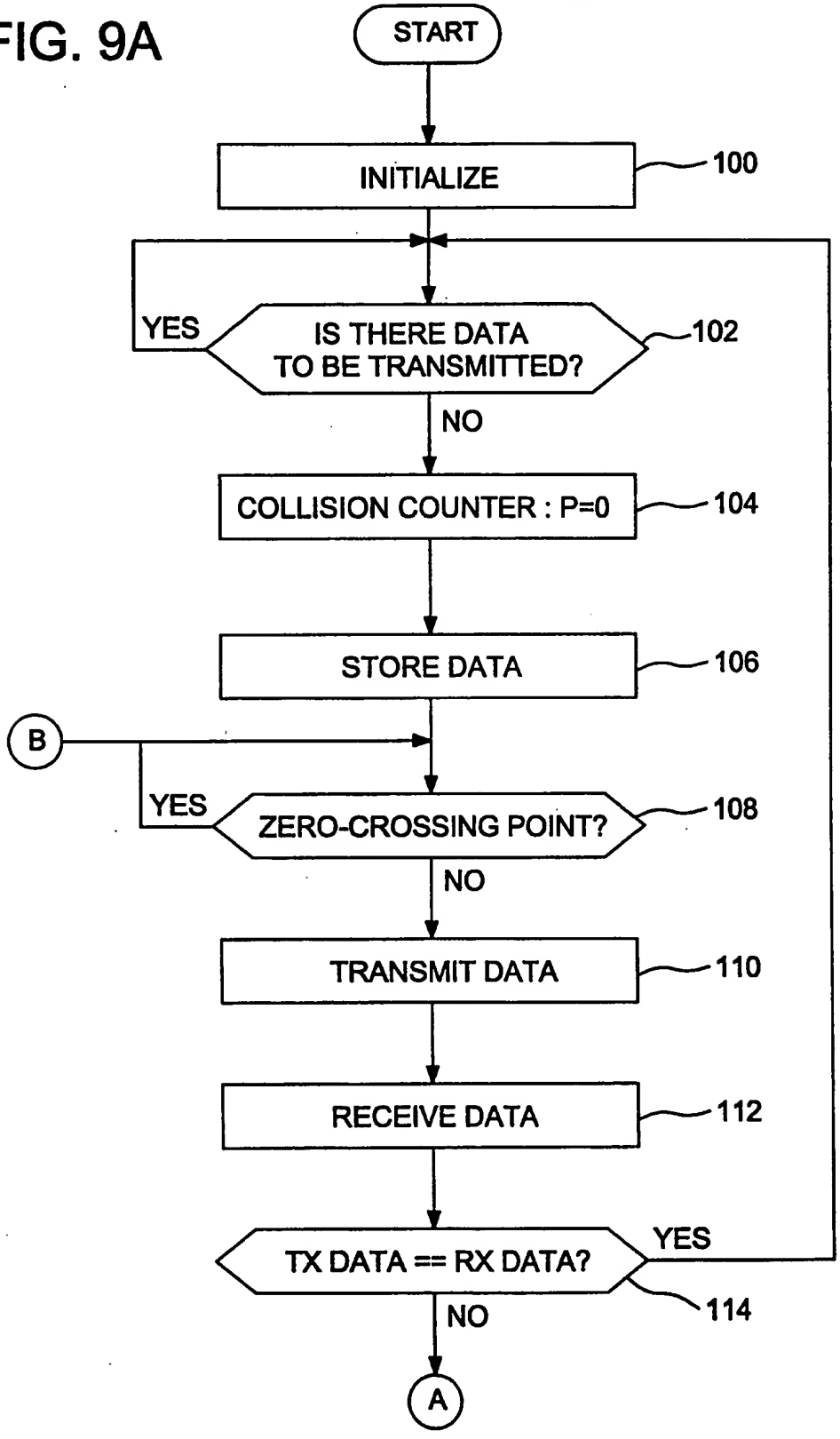
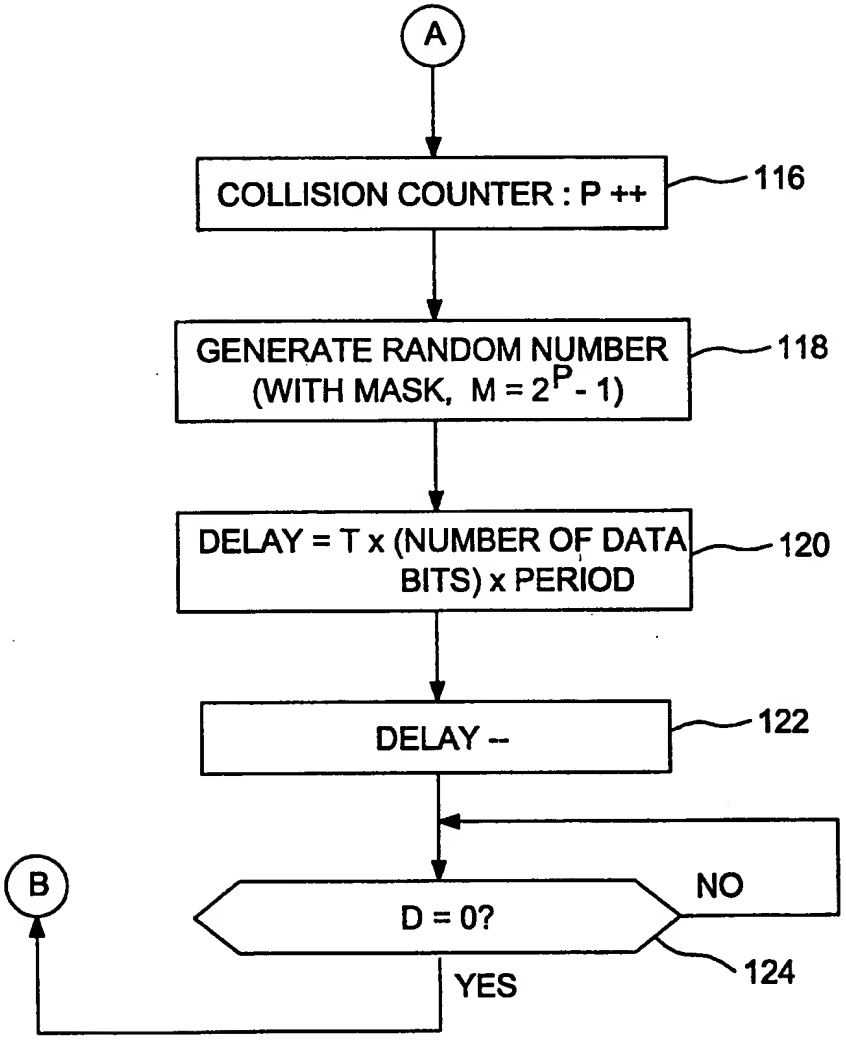

START
INITIALIZE
100
YES
IS THERE DATA TO BE TRANSMITTED?
102
NO
COLLISION COUNTER : P=0
104
STORE DATA
106
B
YES
ZERO-CROSSING POINT?
108
NO
TRANSMIT DATA
110
RECEIVE DATA
112
TX DATA == RX DATA?
YES
114
NO
A

FIG. 9B


A
COLLISION COUNTER : P ++
116
GENERATE RANDOM NUMBER (WITH MASK, M = 2^P - 1)
118
DELAY = T x (NUMBER OF DATA BITS) x PERIOD
120
DELAY --
122
B
D = 0?
NO
YES
124

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00314

A. CLASSIFICATION OF SUBJECT MATTER

IPC[6]: H 04 B 3/54, H 02 J 13/00, H 04 L 12/413

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC[6]: H 04 B, H 04 J, H 04 L

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

WPI

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	EP 0 195 568 A2 (SMITHS INDUSTRIES PUBLIC LIMITED COMPANY) 24 September 1986 (24.09.86), page 2, line 20 - page 3, line 16; claims 4,7.	1,5
A	JP 63 141418 A (HITACHI, LTD.). Patent Abstracts of Japan Vol. 12, No. 402, (E-673) , 25 October 1988 (25.10.88).	1,5
A	DE 3804379 A1 (LIEBSCHER). 24 August 1989 (24.08.89), totality.	1,5
A	EP 0 395 495 A1 (SCHLUMBERGER INDUSTRIES, INC.) 31 October 1990 (31.10.90), claims 1,3,4,6,11.	1,5
A	EP 0 100 668 A2 (SHARP K.K.) 15 February 1984 (15.02.84), claim 1.	1,5
A	JP 10 094 170 A (TOSHIBA CORP.). Patent Abstracts of Japan Vol.9804, No. 8(043), 31 July 1998 (31.07.98).	1,5

☒ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

* Special categories of cited documents:
„A" document defining the general state of the art which is not considered to be of particular relevance
„E" earlier application or patent but published on or after the international filing date
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„O" document referring to an oral disclosure, use, exhibition or other means
„P" document published prior to the international filing date but later than the priority date claimed
„T" later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
„X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
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„&" document member of the same patent family

Date of the actual completion of the international search	Date of mailing of the international search report
13 October 1999 (13.10.99)	08 November 1999 (08.11.99)
Name and mailing adress of the ISA/AT Austrian Patent Office Kohlmarkt 8-10; A-1014 Vienna Facsimile No. 1/53424/200	Authorized officer Mehlmauer Telephone No. 1/53424/376

Form PCT/ISA/210 (second sheet) (July 1998)

INTERNATIONAL SEARCH REPORT

International application No.
PCT/KR 99/00314

C (Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

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INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No.
PCT/KR 99/00314

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		GB B2 2172728	07-04-1988
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		DE T2 69013969	16-03-1995
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JP A2 10094170	10-04-1998	keine - none - rien	